

## Continuation of Creep and Strain Studies in Southern California

Final Technical Report  
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### Introduction

During the past two years of this contract, this Creep and Strain project has continued Caltech's longstanding monitoring of fault slip in the near field with creepmeters (some telemetered), slipmeters, and alignment arrays. This project improves and maintains monitoring instrumentation along the San Andreas fault and Imperial fault in southern and central California. Also, numerous alignment arrays across the San Andreas fault and other active faults are monitored.

Primarily, during the past six months, maintenance and servicing of the instruments has been performed. Also, some of the creepmeter data are telemetered to Caltech from several stations, and our most recent work has substantially improved the satellite telemetry. These efforts have resulted in much lower field maintenance for these instruments during the past year. We have, in particular, accomplished modifications of our data retrieval software to work with recent changes in the GOES satellite telemetry system.

We continue to maintain our creepmeters and slipmeters; creepmeters on the Imperial fault are located at Ross Road (telemetered), Heber Road, Tuttle Ranch, and Harris Road (Brawley fault). Caltech creepmeters on the southern San Andreas fault are at Salt Creek (telemetered), Mecca Beach, and North Shore (telemetered). Slipmeters are at Lost Lake (near Cajon Pass), Jack Ranch (Parkfield area), and Twisselman Ranch (Cholame segment).

### Recent Problem Solved

Problems with adapting our creepmeter telemetry datalogging software to changes in the GOES system hampered us until recently. Fortunately, no creep events occurred during the few months when our automated demultiplexing and archiving were down. The datalogging was maintained during this time, and weekly manual decoding checks were performed (to see if instruments were performing well, and look for any large creep signals). Now that we have updated our demultiplexing and archiving software, we still need to re-process (and archive) these backlogged data.

### Recent Results

During March and April of 1991, we have recorded numerous creep signals on our telemetered creepmeters on the Imperial and San Andreas faults. The first possibly significant one of these was recorded at both Salt Creek and North Shore [Figure 1], on Julian Day (JD) ~060, shortly after heavy rainfall throughout southern California. We actually record air temperature, and we noted rapid changes at this time - probably associated with a passing storm front and rain in the area. Perhaps importantly, this rain followed a drought of several years' duration.

The creep event we recorded on the southern San Andreas fault was right-lateral, and lasted about 2 days, at both sites. The amplitudes recorded were only 0.4 - 0.5 mm at Salt Creek, and 0.3 mm at North Shore. Particularly because of the small amplitude of the creep observed at this time, and low signal-to-noise ratio, we made no formal notice of the event, though we briefly discussed it with colleagues at Caltech and at the USGS.

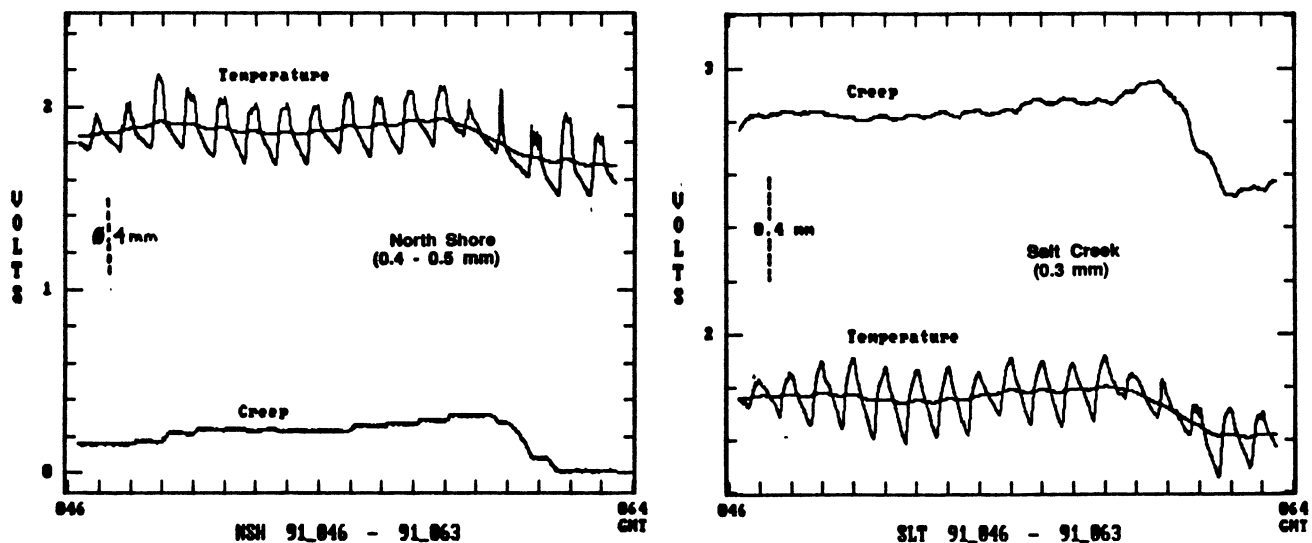


Figure 1. Records of the small creep event on the San Andreas fault (JD 059-061), as recorded at both the North Shore and Salt Creek telemetered creepmeter sites.

More recently (JD 091), a creep event was recorded at Ross Road on the Imperial fault. This event [Figure 2] had an amplitude of about 9.3 mm. The event was not accompanied by any particularly notable air temperature (and possibly rain) changes. Interestingly, a similar creep event (of 7.0 mm amplitude) was observed by the Ross Road instrument on JD 093 of 1990 [Figure 3]. The creep event in 1990 did not cause measureable creep at any of the non-telemetered creepmeters adjacent to Ross Rd. For the recent creep event of JD 091, 1991, we have not yet been to the field to check our other instruments. They will be checked and serviced next week, so we will determine at that time whether or not this creep event has been recorded by our non-telemetered creepmeters on the Imperial fault. We did not record any creep on either of the telemetered creepmeters on the San Andreas fault at (or near) the same time.

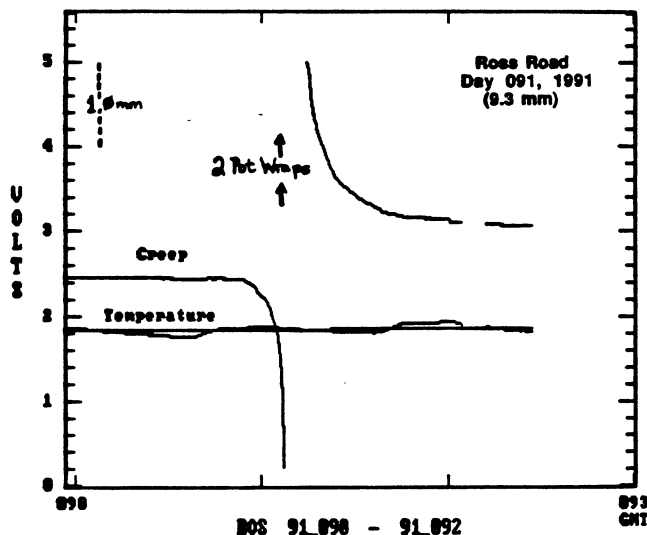


Figure 2. Records of the JD 091, 1991 creep event on the Imperial fault, as recorded at the Ross Road telemetered creepmeter site. Note similarity in amplitude and time of year to the 1990 creep event shown in Fig. 3.

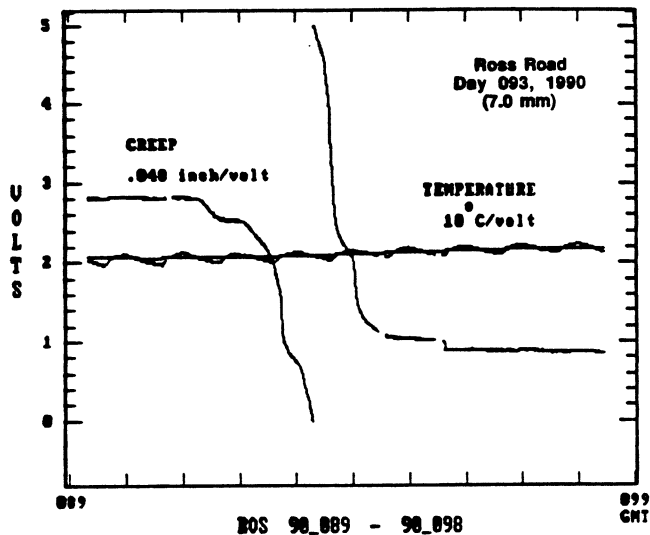


Figure 3. Records of the JD 093, 1990 creep event on the Imperial fault, as recorded at the Ross Road telemetered creepmeter site. This creep event was only recorded at Ross Road.

Because this creep event on JD 091, 1991 at Ross Road was recorded at well above the noise level, and the amplitude was substantial, we have reported this creep event semi-formally (by email and telephone) to several colleagues at Caltech and the USGS. Until we can see if the other creepmeters recorded the event, we cannot be sure that this is like the 1990 creep event (that was localized at Ross Road). We are curious to get this result, but would not plan to make any formal notification until the results of our field trip come in. It is interesting to note that a 5 mm creep event on two instruments at Parkfield has recently caused a B-level alert there - this may be causally associated with the recent rains (W. Prescott, USGS, *pers. comm.*). In the case of Parkfield, however, such an event is clearly unusual, whereas the 9.3 mm event we've just recorded at Ross Road may not be so unusual.

### **Concluding Remark**

This project has been generating data for 25 years, and these data have all been archived at Caltech. Caltech will continue to maintain this project, and continue to improve our capabilities, funding permitting. At present, we have merged the Creep and Strain project into our Earthquake Geodesy project, since there is much overlap, both scientifically and in terms of personnel involved, between the two. Unfortunately, this merger resulted in a \$50,000 cut in combined funding of the Creep and Strain and GPS projects from 1990 to 1991, despite reviewers' comments that this merger seemed a logical step on our part. This radical cut in our funds has necessitated drastic humbling of our plans for Creep and Strain work in 1991, though we hope to be able to maintain the telemetered creepmeters, at least. Our hopes to survey and upgrade a number of the alignment arrays and to install telemetry at additional creepmeter sites, have been dashed for 1991.